UTAH DEPARTMENT OF NATURAL RESOURCES

Willard Spur Fishery Investigation

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Introduction

The Great Salt Lake is a large terminal lake in western North America with salinities ranging from <1% to 30%. While fish cannot survive in the hypersaline waters of the main lake, there exist bays and wetlands on the periphery of the lake that receive significant freshwater inflow and sustain fisheries. The Willard Spur is one such wetland and is located in the Bear River Bay arm of the lake. While the fish inhabiting the Willard Spur provide food for birds such as pelicans and turns, the area has never gained popularity as a recreational fishery due to its often shallow water levels, limited access, and the relatively low densities of sportfish. Given its relatively low utilization as a recreational fishery, little data exists regarding the diversity and abundance of fish that inhabit the Willard Spur. As part of a concurrent study investigating what water quality standards are necessary to protect the beneficial uses of the Willard Spur, it was necessary to investigate the composition and diversity of fish that inhabit this unique fishery.

Methods

Field Methodology

One experimental gill net and one minnow trap were deployed at four sites on the morning of August 12, 2012 (Figure 1). Efforts were made to sample the same sites as those used in a 2011 investigation of fish diversity in the Willard Spur (Moore 2011), however; thus far the 2012 water year has been one of drought, leaving all sample sites from the previous study with water depths barely exceeding 12 inches. With this in mind, two nets and two minnow traps were set at the two deepest sites from the previous year (~14 inches deep), while an additional two new sample sites were chosen and netted in the canal near the outlet of Willard Bay Reservoir. The new sites chosen in the canal area had depths of up to 36 inches. All water levels encountered in the Willard Spur were not deep enough for gill nets to extend fully to their depth of six feet. In order to make sure gill nets fished properly, each net was anchored on both ends with a steel fence post, while a six-foot bamboo stake was used every 15 feet to extend the net to its full height and provide additional support (Figure 2). Minnow traps were placed adjacent to each gill net set in open water, while those in the canal were set near woody debris a few feet from

shore. Each minnow trap was baited with a small handful of dry cat food. Fish collected were measured to the nearest millimeter and identified to species.

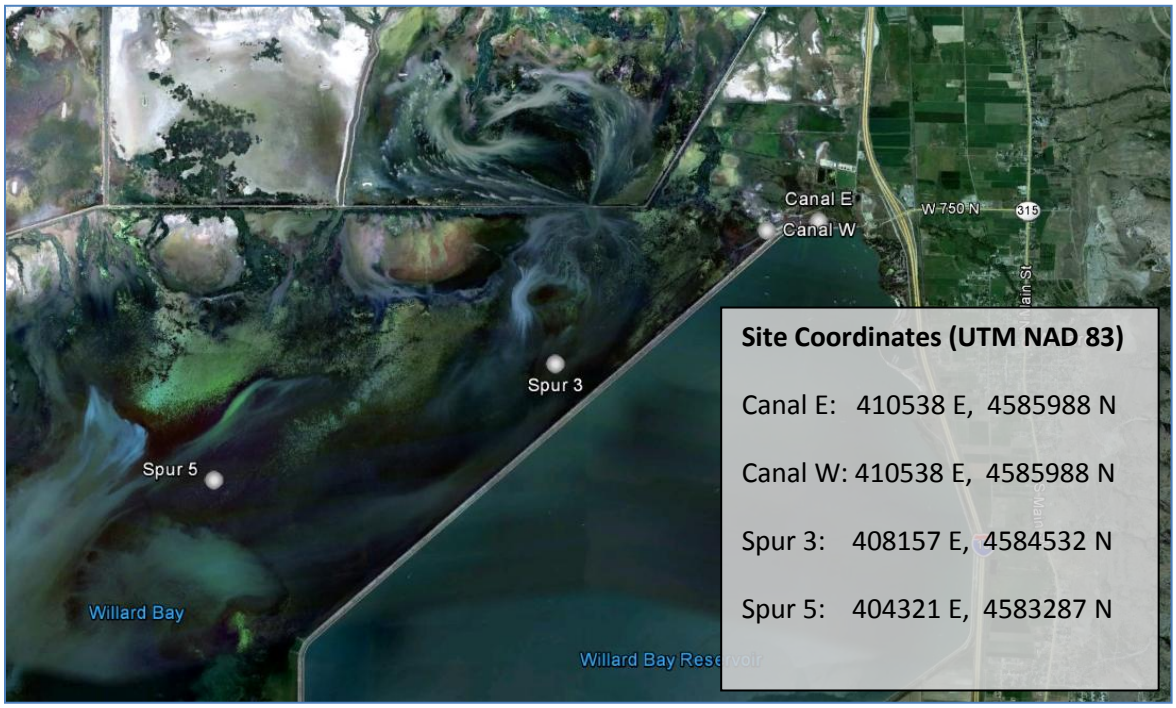

Figure 1.—Location of gill nets and minnow traps deployed in the Willard Spur, August 2012.

Figure 2. —A gill net deployed in the Willard Spur. Each end of the net is anchored with steel fence posts and the body supported by bamboo stakes.

Analysis and Interpretation of Data

Data collected was used to characterize the fish community in the Willard Spur in terms of species composition, diversity, relative abundance, biomass, and length structure. Species composition and length structure were summarized using tables and figures. Keeping consistent with the previous study (Moore 2011), individual weights and biomass of species captured were estimated using published length-weight regressions (Bister et al. 2000; Bonar et al. 2009), and in the case of Utah Chub, an existing regression generated by the Utah Division of Wildlife Resources (UDWR 2010, unpublished data). Species diversity and relative abundance were characterized using community indices of diversity and evenness.

The Shannon's Diversity Index was used to characterize fish community diversity overall as well as among sites. Shannon's Index was calculated as:

$$H' = -\sum_{i=1}^{s} p_i \ln p_i$$

where, s = number of species, and p_i= the proportion of the total sample represented by the *i*th species. Diversity is expressed as "nats per individual" with "nats" referring to the natural logarithm used in caculating the index. In Shannon Index, diversity increases with the number of nats per individual. Shannon's index rarely exceeds a value of 5.0 nats per individual (Washington 1984, cited by Kwak and Peterson 2007).

Calculations of evenness based on Shannon's Diversity Index were then used to characterize relative abundance among sites. Evenness was calculated to express the proportion of diversity observed relative to the maximum diversity for the specific number of species and sample size. Eveness based on Shannon's index was calculated as:

$$E = \frac{H'}{H'_{\max}}$$

where $H'_{max}=\log_e s$= maximum possible value of Shannon's index, and s= number of species, and H'=the Shannon's Index value. Measures of evenness range from 0 to 1.0 and are unitless proportions, with a value of 1.0 indicating an equal number of individuals counted among the species observed.

Results and Discussion

A total of 107 fish representing seven different species were sampled during the investigation (Table 1). Species sampled include common carp (*Cyprinus carpio*); Utah chub (*Gila atraria*); black bullhead (*Ameiurus melas)*, yellow perch (*Perca flavescens*); black crappie (*Poxomis nigromaculatus*); channel catfish (*Ictaluris punctatis*); and gizzard shad (*Dorosoma cepedianum*). Fish were found at all sites surveyed during the investigation, with the most numbers and species of fish being sampled at the two sites located in the canal (Figure 3). Alternatively, the two sites in the main body of the spur, Station 5 and Station 3, were dominated by common carp and Utah chub.

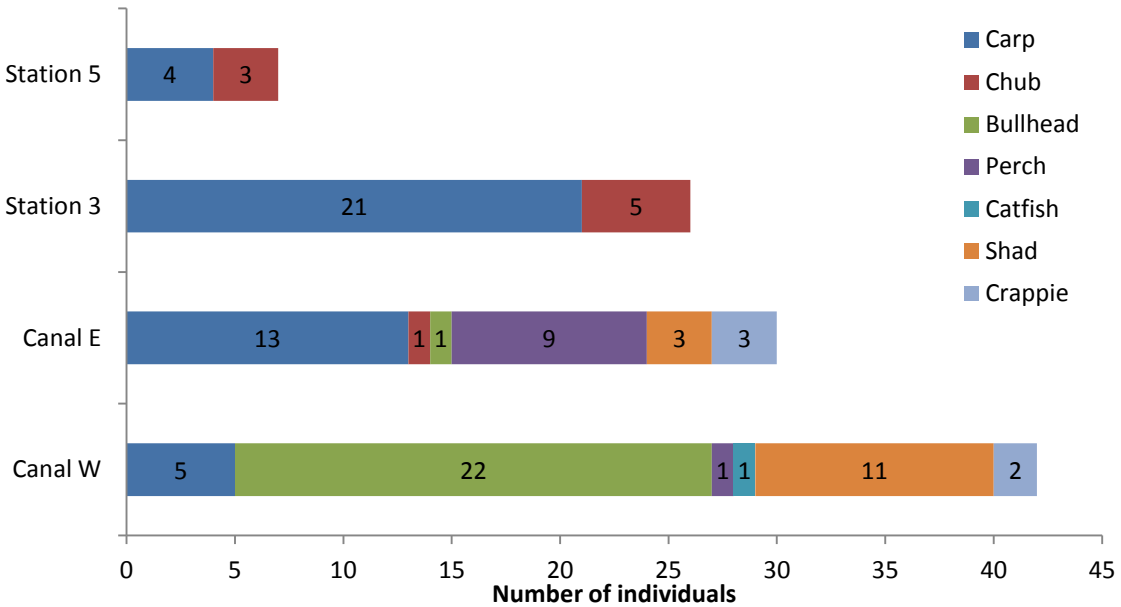

Figure 3.—Species composition and numbers surveyed in the Willard Spur by site.

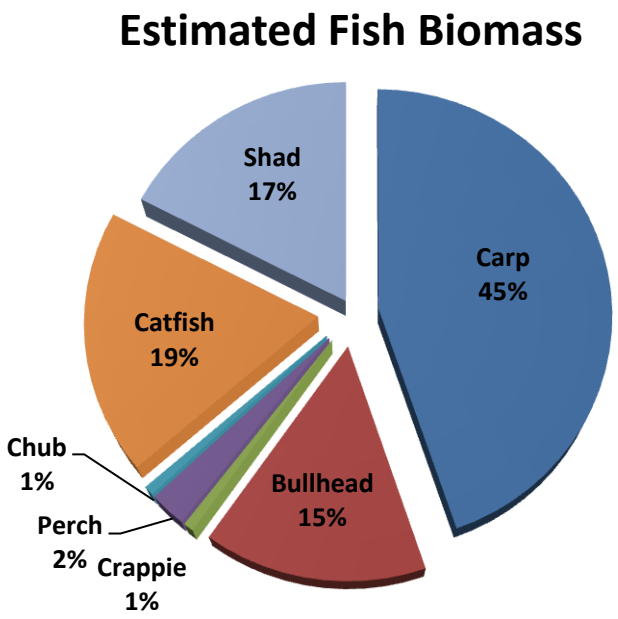

Figure 3.— Estimated composition of fish biomass sampled from the Willard Spur.

Table 1. Species composition, length structure, and estimated weight of sampled fish from the Willard Spur in 2012.

Species	Catch	Length range (mm)	Mean length (mm)	Mean length (SE)	Est. mean weight (g)
Common carp	43	70 - 326	138.1	10.7	74
Utah chub	9	80 -250	129.7	8.3	5
Black bullhead	23	97 -155	110.3	5.5	47
Black crappie	5	85 - 265	172.6	21.7	10
Yellow perch	12	25 -110	65.3	12.0	18
Gizzard Shad	14	86 - 109	94.4	3.9	89
Channel catfish	1	514	514	-	1349

Common carp dominated the total catch in both numbers and biomass. They represented 40% of the individuals and 45% of the biomass sampled (Figure 4). Further, they were the only species sampled at all four sites.

Table 2. Diversity and relative abundance of fish sampled among sites at the Willard Spur.

Site	Shannon Weaver Index	Evenness
Station 5	0.68	0.99
Station 3	0.49	0.71
Canal W	1.26	0.70
Canal E	1.41	0.79

Fish diversity was highest at the survey sites located within the canal (Table 2). Site Canal E, which was located closest to the outlet of Willard Bay Reservoir, exhibited the most diversity. While water was not being diverted from Willard Bay Reservoir into the Willard Spur during the time of sampling, site Canal E had the deepest available water of all the sites sampled, which may have had a direct influence on the catch observed at that site. Evenness, based on Shannon's Index, was highest at Station 5 and Canal E, indicating that these sites exhibited the most even distribution of fish numbers by species.

References

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